PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2005-350756
(43)Date of publication of application : 22.12.2005

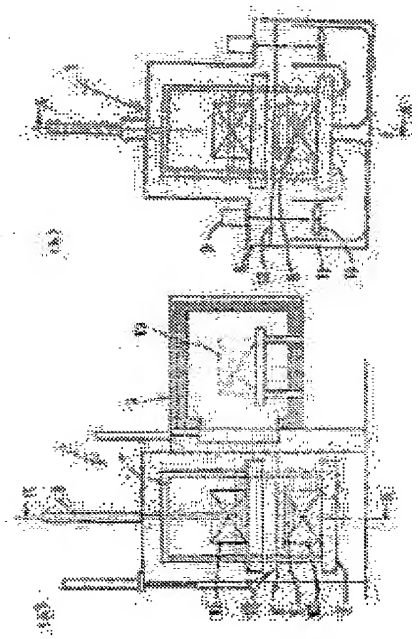
(51)Int.Cl. C21D 1/64
C21D 1/00

(21)Application number : 2004-175349
(22)Date of filing : 14.06.2004

(71)Applicant : NACHI FUJIKOSHI CORP
(72)Inventor : IWAGAMI YOSHIYUKI
HARAI SATORU

(54) HEAT TREATMENT APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a heat treatment apparatus for cooling a heated steel work by immersing it into oil in a quenching oil tank, wherein the vapor layer adhering to the surface of the steel work can be sufficiently separated and removed.
SOLUTION: A quenching chamber 2 having a quenching oil tank 6 holding a cooling oil 8 and a steel work W1 mounted on the elevator 7 of the quenching chamber 2 are allowed to elevate by means of an elevator cylinder 4 formed on the top of the quenching chamber 2. When the steel work W1 kept immersed into the oil 8 in the quenching oil tank 6 is elevated, vertical microvibrations are applied to the elevating cylinder 4 by means of an oscillator.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
A thermal treatment equipment comprising:
A hardening room which has the quenching oil tub which put in an oil coolant.
An excitation apparatus which adds minute vibration of a lengthwise direction to said work ascending and descending means when descending and raising said steel-materials work in the state where it was immersed in a work ascending and descending means which descends and raises a heated steel-materials work which was provided in a hardening room, and an oil in said quenching oil tub.

[Claim 2]
Pitch of said minute vibration of said excitation apparatus is 1-50 Hz and amplitude. The thermal treatment equipment according to claim 1 by which being referred to as 0.1-1 mm.
[Claim 3]
Add minute vibration of a lengthwise direction to said work ascending and descending means, and said steel-materials work Multiple-times repetition descent, The thermal treatment equipment according to claim 1 or 2 carrying out predetermined time continuation to backward [in which it is made to make it go up and/or said steel-materials work went up from a fuel level in said quenching oil tub], and adding said minute vibration to said work ascending and descending means.
[Claim 4]
Claim 1 being able to provide a stirring fan and a rectification duct which stir and cool an oil in a quenching oil tub after hardening of said steel-materials work was completed in said quenching oil tub and a steel-materials work had appeared in it out of said oil, the thermal treatment equipment according to claim 2 or 3.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to the thermal treatment equipment which immerses the heated steel-materials work in the oil in the quenching oil tub of a hardening room, and is cooled.
[Background of the Invention]
[0002]
When the heated steel-materials work is immersed in the oil in the quenching oil tub of a hardening room and it cools, There are a steam film stage, a boil stage, and a convection stage after being immersed in quenching oil, the steam film which adhered to the surface of the steel-materials work in the steam film stage remains, it becomes the cooling unevenness of a steel-materials work surface with this steam film, and generating modification of a steel-materials work and distortion is known well. As a thermal treatment equipment into which the steam film adhering to the surface of this steel-materials work is made to separate from a steel-materials work, For example, with the patent documents 1, the thermal treatment equipment which repeats the steel-materials work which immersed the steel-materials work in the state where it was immersed in the oil in a quenching oil tub two or more times, and displaces it up and down is indicated, and the thermal treatment equipment which vibrates and stirs the oil of a quenching oil tub by vibration and a stirring means is indicated with the patent documents 2 and the patent documents 3.
[Patent documents 1] JP,2000-129339,A gazette
[Patent documents 2] JP,2001-64722,A
[Patent documents 3] JP,2003-286517,A
[Description of the Invention]
[Problem to be solved by the invention]
[0003]
. Repeat the steel-materials work which immersed the steel-materials work in the state where it was immersed in the oil in a quenching oil tub, in the thermal treatment equipment into which the steam film adhering to the surface of the steel-materials work of the conventional patent documents 1 is made to separate from a steel-materials work two or more times, and displace it up and down. The steam film by which it will be generated by the time it is immersed thoroughly, since a steel-materials work begins to immerse in an oil has adhered to the surface of a steel-materials work, and make it displaced up and down repeatedly two or more times, and in a chisel. A steam film could not be made to fully separate from a steel-materials work, but modification of the steel-materials work by these remains steam film and distortion were generated. Although it vibrates and the oil of a quenching oil tub is stirred by vibration and a stirring means in the patent documents 2 and the patent documents 3, Although the flow of the oil spread from vibration and a stirring means is effective in the steam film of the steel-materials work surface touched directly to some extent, vibration and steam film removal of the steel-materials work surface of the position which becomes a dead angle to a stirring means were not completed, and modification of the steel-materials work by these remains steam film and distortion were generated.
[0004]
In the thermal treatment equipment which SUBJECT of this invention immerses the heated

steel-materials work which solved SUBJECT of the conventional technology mentioned above in the oil in a quenching oil tub, and is cooled, It is in providing the thermal treatment equipment which makes all the steel-materials works that fully separated and removed the steam film adhering to the surface of a steel-materials work from the steel-materials work, and were carried in the tray or the basket cool in an oil on the same conditions.

[Means for solving problem]

[0005]

For this reason, the hardening room which has the quenching oil tub which put in the oil coolant according to this invention, The work ascending and descending means which descends and raises the heated steel-materials work which was provided in the hardening room, When descending and raising said steel-materials work in the state where it was immersed in the oil in said quenching oil tub, SUBJECT of above-mentioned this invention was solved with the thermal treatment equipment having an excitation apparatus which adds minute vibration of a lengthwise direction to said work ascending and descending means.

[Effect of the Invention]

[0006]

Since it has an excitation apparatus which adds minute vibration of a lengthwise direction to a work ascending and descending means when descending and raising a steel-materials work in the state where it was immersed in the oil in a quenching oil tub, in this invention, Also in [in the steam film stage after a steel-materials work being immersed in the oil in a quenching oil tub, can remove a steam film from a steel-materials work, and] a boil stage, It became what provides the thermal treatment equipment which makes all the steel-materials works that thin stirring of the oil was generated, and equalization of the oil temperature was attained, and fully separated and removed the steam film adhering to the surface of a steel-materials work from the steel-materials work, and were carried in the tray or the basket cool in an oil on the same conditions.

[0007]

Preferably, the pitch of said minute vibration of said excitation apparatus is 1-50 Hz and amplitude. It is good also as 0.1-1 mm. In pitch, 1 or amplitude. By less than 0.1, compared with the crevice between the connecting parts of a work ascending and descending means and an excitation apparatus, pitch or amplitude is small and an excitation apparatus has a possibility that a work ascending and descending means may not follow, Since equipment will become large too much if pitch exceeds 50 Hz or the amplitude of 1 mm, pitch is 1-50 Hz and amplitude. It limited to 0.1-1 mm.

Add minute vibration of a lengthwise direction to said work ascending and descending means, and multiple-times-repetition-descend and it is made to raise said steel-materials work still more preferably, Dissociate, remove the steam film adhering to the surface of a steel-materials work from a steel-materials work, and more fully And/. Or as predetermined time continuation is carried out to backward [in which the steel-materials work went up from the fuel level in a quenching oil tub] and minute vibration is added to a work ascending and descending means, it may be made to shake the oil adhering to the surface of a steel-materials work off.

[Best Mode of Carrying Out the Invention]

[0008]

With reference to Drawings, it explains about the best form for carrying out this invention. Drawing 1 (a) is a schematic block diagram of the thermal treatment equipment as a yne out type batch type furnace (form which carries in and takes out a work from the same entrance) of the best form for carrying out this invention, The outline sectional view which met the A-A line of drawing 1 (b) shows, and the important section outline sectional view which met the B-B line of (a) shows drawing 1 (b). Drawing 2 shows the driver system of the excitation apparatus which adds minute vibration of a lengthwise direction to the elevator rise-and-fall cylinder 4 which is a work ascending and descending means of drawing 1 (a) in a hydraulic-circuit figure, Drawing 3 shows each locus of various operation patterns which descends and raises the steel-materials work W1, adding minute vibration of a lengthwise direction to the elevator rise-and-fall cylinder 4 of drawing 1 (a).

[0009]

As shown in drawing 1 (a), the thermal treatment equipment 1 of the best form for carrying out this invention, Steel-materials work W3 shown by the dotted line heated by the hardening room 2

which has the quenching oil tub 6 which put in the oil coolant 8, the heat chamber 3 which heats with the heating apparatus which is not illustrated, and the heat chamber 3, ** and others, After being moved onto the elevator 7 shown as the solid line of the hardening room 2 by the transportation device which is not illustrated, the steel-materials work W1 carried in the elevator 7 of the hardening room 2 is descended and raised in the elevator rise-and-fall cylinder 4 formed in the hardening room 2 upper parts. When descending and raising the steel-materials work W1 in the state where it was immersed in the oil 8 in the quenching oil tub 6, minute vibration of a lengthwise direction is added to the elevator rise-and-fall cylinder 4 by the excitation apparatus shown in drawing 2.

[0010]

As shown in drawing 1 (b), steel-materials work W2 hardening is completed to the quenching oil tub 6, and after the steel-materials work W2 has come out out of the oil 8, the stirring fan 10 and the rectification duct 11 which rotate the oil 8 in the quenching oil tub 6 by the motor 9 stirred and cooled are provided in it. While the elevator rise-and-fall cylinder 4 operates, the stirring fan 10 is made into a halt condition, hardening ends him, and the steel-materials work W2 is in the state which came out out of the oil 8, Stirring and cooling of are done until it rotates the stirring fan 10 by the motor 9 and reaches a predetermined temperature in the oil 8 by the heat exchanger which was provided in the quenching oil tub 6 and which is not illustrated, cooling.

[0011]

The driver system of the excitation apparatus made to generate minute vibration of a lengthwise direction in the elevator rise-and-fall cylinder 4 shown in drawing 2, As shown in the hydraulic-circuit figure of drawing 2, The position sensor 53 attached to the rod 52 of the elevator rise-and-fall cylinder 4 which is an excitation cylinder, The feedback position signal of the position sensor 53. The amplifier 56 for vertical excitation servo driving into which the feedback position signal of the amplifier 54 for servo driving and the amplifier 54 for servo driving to amplify is inputted, the function generator 55 for lengthwise direction excitation which orders it the pitch, amplitude, and differential pressure of the rod 52 of the elevator rise-and-fall cylinder 4 which is an excitation cylinder, The pitch, the amplitude, and the differential pressure command signal of the function generator 55 for lengthwise direction excitation are inputted into the above-mentioned amplifier 56 for vertical excitation servo driving, and contains the servo valve 57 for vertical excitation made to generate the pitch, amplitude, and differential pressure according to the command signal which orders it the pitch, amplitude, and differential pressure of the amplifier 56 for vertical excitation servo driving. The servo valve 57 for vertical excitation is connected with the elevator rise-and-fall cylinder 4 which is the hydraulic pump 59 and excitation cylinder which are driven on the motor 58. Driver system equipment other than elevator rise-and-fall cylinder 4 which is an excitation cylinder is arranged at the position which adjoined the hardening room 2 and which is not illustrated. If the feedback position signal of the position sensor 53 detects that the steel-materials work W1 in the elevator 7 supported by the elevator rise-and-fall cylinder 4 approached the fuel level 12 of the oil 8 in the quenching oil tub 6, The command signal which orders it the pitch, amplitude, and differential pressure which carried out bulldozing with the function generator 55 for lengthwise direction excitation is generated, and the servo valve 57 for vertical excitation makes the rod 52 of the elevator rise-and-fall cylinder 4 which is an excitation cylinder generate the pitch, amplitude, and differential pressure according to a command signal. The vertical vibration condition at this time has a preferred minute vibration whose pitch is 1-50 Hz and the amplitude of 0.1-1 mm. In pitch, 1 or amplitude. By less than 0.1, compared with the crevice between the connecting parts of the rod 52 of the elevator rise-and-fall cylinder 4, and the excitation cylinder 51, pitch or amplitude is small and an excitation apparatus has a possibility that a work ascending and descending means may not follow, It is because equipment will become large too much if pitch exceeds 50 Hz or the amplitude of 1 mm.

[0012]

Drawing 3 shows each locus of various operation patterns which adds minute vibration of a lengthwise direction to the rod 52 of the elevator rise-and-fall cylinder 4 which is a work ascending and descending means of drawing 1 (a), descends and raises the steel-materials work W1. The elevator 7 and the steel-materials work W1 which are shown as the solid line of drawing

1 drawing 3 (a) from an original position, i.e., raised end position, It descends with a rapid traverse until it approaches the fuel level 12 of the oil 8 in the quenching oil tub 6, After a **** start descends to the lowering end position of the elevator 7 shown by the dotted line of drawing 1, and the steel-materials work W2, adding lengthwise direction excitation to the rod 52 of the elevator rise-and-fall cylinder 4 which is an excitation cylinder about the pitch, amplitude, and differential pressure which carried out bulldozing beforehand. In lowering end position, the elevator 7 and the steel-materials work W2 are raised, adding lengthwise direction excitation by the timer which is not illustrated, after [slight] carrying out a time stop. The steel-materials work W2 bottom stops lengthwise direction excitation, and return is already made to be carried out in the position which went up to the fuel level 12 of the oil 8 to raised end position.

[0013]

Unlike drawing 3 (a), until after the steel-materials work W2 goes up from the fuel level 12 of the oil 8 in the quenching oil tub 6, drawing 3 (b) carries out predetermined time continuation, and adds minute vibration to the rod 52 of the elevator rise-and-fall cylinder 4, The oil adhering to the surface of a steel-materials work is shaken off, and the oil carried out out of the oil tank 6 is decreased.

Drawing 3 (c) multiple-times-repetition-descends, and it is made to raise the pattern of drawing 3 (a), and it dissociates and it more fully removed the steam film adhering to the surface of a steel-materials work from the steel-materials work.

Drawing 3 (d) puts the pattern of drawing 3 (b) on drawing 3 (c), and the pattern of drawing 3 (a) Multiple-times repetition descent, Predetermined time continuation is carried out to backward [in which it is made to make it go up, and the steel-materials work W2 went up from the fuel level 12 of the oil 8 in the quenching oil tub 6], and minute vibration is added to the rod 52 of the elevator rise-and-fall cylinder 4.

[Work example 1]

[0014]

Construction material SCr420, module 2.0, 20 degrees of pressure angles, the number of teeth 76, twist angle RH of 30 degrees, Pitch diameter The thermal treatment equipment 1 of this invention in which ten with 175.524 mm and a face width of 24 mm helical external gears are shown by drawing 1 was used, and the temperature was lowered to 850 **C after heat treatment which added carburizing treatment, and with the equipment of this invention, in the oil of oil-temperature 150 **C, it was immersed and hardened. When the amount of twist angular distortion of the helical external gear after hardening was measured by the method of this invention, they were the deformation of 10-25 micrometers, and dispersion. Without adding lengthwise direction excitation to the rod 52 of the elevator rise-and-fall cylinder 4, stirring ten helical external gears before hardening of the same specification using the stirring fan 10 who shows drawing 1 (b), and the rectification duct 11 Descent, When it hardened by the conventional method to raise and the amount of twist angular distortion of the helical external gear after hardening was measured, they were the deformation of 20-45 micrometers, and dispersion. Compared with what was hardened by the conventional method, deformation and dispersion carried out the abbreviation reduction by half of the amount of twist angular distortion of the helical external gear hardened with the equipment of this invention.

[The effect of the best embodiment of this invention]

[0015]

Since it has an excitation apparatus which adds minute vibration of a lengthwise direction to a work ascending and descending means when descending and raising a steel-materials work in the state where it was immersed in the oil in a quenching oil tub, in the best embodiment of this invention, Also in [in the steam film stage after a steel-materials work being immersed in the oil in a quenching oil tub, can remove a steam film from a steel-materials work, and] a boil stage, It became what provides the thermal treatment equipment which makes all the steel-materials works that thin stirring of the oil was generated, the chilling effect was given to the oil, and equalization of the oil temperature was attained, and fully separated and removed the steam film adhering to the surface of a steel-materials work from the steel-materials work, and were carried in the tray or the basket cool in an oil on the same conditions.

[0016]

Preferably, the pitch of minute vibration of an excitation apparatus is 1-50 Hz and amplitude. It

is good also as 0.1-1 mm. In pitch, 1 or amplitude. By less than 0.1, compared with the crevice between the connecting parts of a work ascending and descending means and an excitation apparatus, pitch or amplitude is small and an excitation apparatus has a possibility that a work ascending and descending means may not follow, Since equipment will become large too much if pitch exceeds 50 Hz or the amplitude of 1 mm, pitch is 1-50 Hz and amplitude. It limited to 0.1-1 mm.

Add minute vibration of a lengthwise direction to the rod of an elevator rise-and-fall cylinder, and multiple-times-repetition-descend and it is made to raise a steel-materials work still more preferably, Carry out predetermined time continuation to backward [in which dissociated, and more fully removed the steam film adhering to the surface of a steel-materials work from the steel-materials work, and/or the steel-materials work went up from the fuel level in a quenching oil tub], and minute vibration is added to a work ascending and descending means, It may be made to shake the oil adhering to the surface of a steel-materials work off.

[0017]

Although an example of a cylinder explained an elevator ascending and descending means in the best embodiment of this invention, Although elevator ascending and descending means may be electric drive means, such as a servo motor, and an example of a thermal treatment equipment as a yne out type batch type furnace explained in an embodiment, It can be used for all the thermal treatment equipments which have a hardening room which has the quenching oil tub which put in an oil coolant, and a work ascending and descending means which descends and raises a heated steel-materials work which was provided in a hardening room.

[Brief Description of the Drawings]

[0018]

[Drawing 1](a) is a schematic block diagram of the thermal treatment equipment as a yne out type batch type furnace of the best form for carrying out this invention, and the outline sectional view which met the A-A line of drawing 1 (b) shows it, and it shows drawing 1 (b) with the important section outline sectional view which met the B-B line of (a).

[Drawing 2]A hydraulic-circuit figure shows the driver system of the excitation apparatus which adds minute vibration of a lengthwise direction to the elevator rise-and-fall cylinder 4 which is a work ascending and descending means of drawing 1 (a).

[Drawing 3]Each locus of various operation patterns which descends and raises the steel-materials work W1 is shown adding minute vibration of a lengthwise direction to the elevator rise-and-fall cylinder 4 of drawing 1 (a).

[Explanations of letters or numerals]

[0019]

1: Thermal-treatment-equipment 2 : hardening room
4: Elevator rise-and-fall cylinder (work ascending and descending means)
6: Quenching oil tub 7 : elevator
8: Oil coolant 10:stirring fan 11 : rectification duct
W1, W2, W3: Steel-materials work

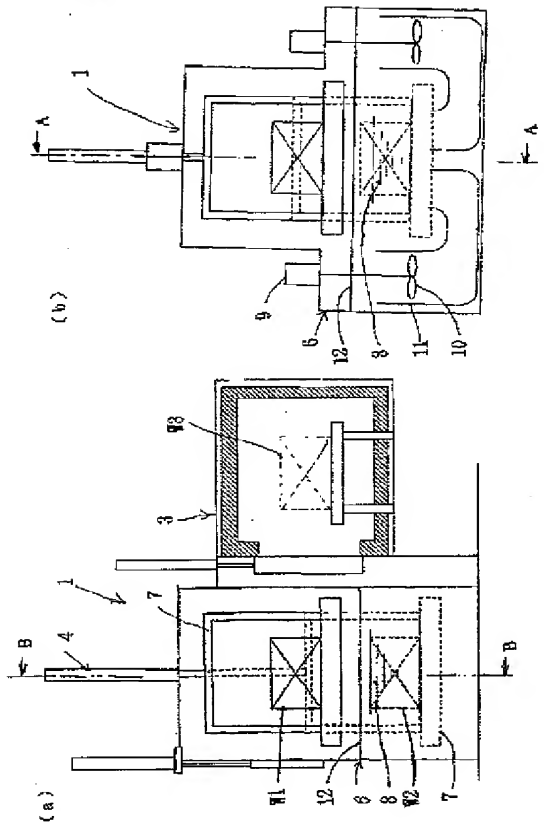
[Translation done.]

* NOTICES *

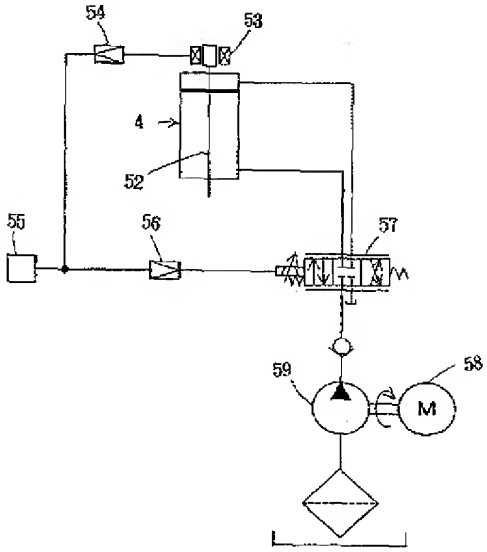
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

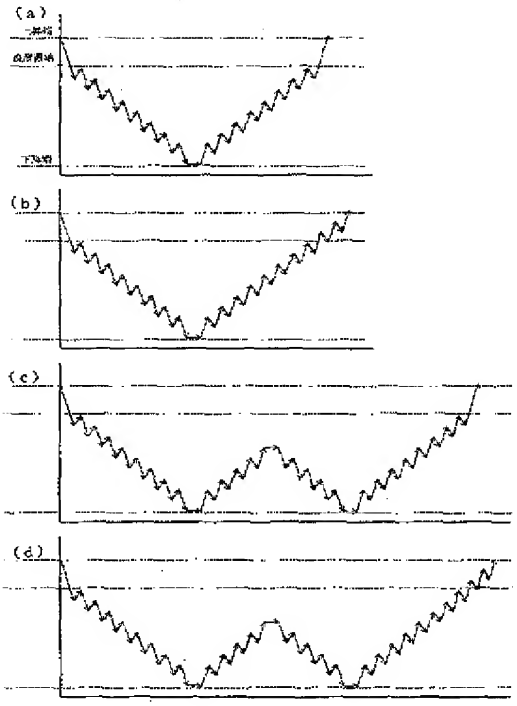
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2005-350756
(P2005-350756A)
(43)公開日　平成17年12月22日(2005.12.22)

(51)Int.Cl.[7]	F I		テーマコード（参考）
C21D 1/64	C21D 1/64		4K034
C21D 1/00	C21D 1/00	120	

審査請求 未請求　請求項の数 4　OL　（全 7 頁）

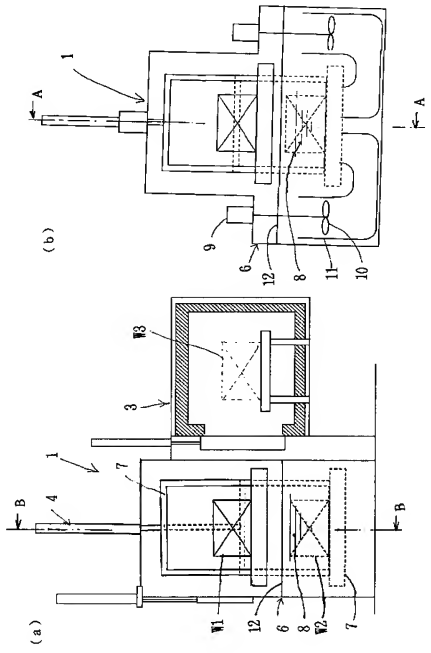
(21)出願番号　特願2004-175349 (P2004-175349)
(22)出願日　平成16年6月14日 (2004.6.14)

(71)出願人　000005197
株式会社不二越
富山県富山市不二越本町一丁目1番1号
(74)代理人　100077997
弁理士　河内　潤二
(72)発明者　岩上　良行
富山県富山市不二越本町一丁目1番1号株式会社不二越内
(72)発明者　原井　哲
富山県富山市不二越本町一丁目1番1号株式会社不二越内

Fターム(参考)　4K034 AA02 BA10 CA04 DB03 FA06 FB12

(54)【発明の名称】熱処理装置

(57)【要約】　（修正有）
【課題】加熱された鋼材ワークを焼入れ油槽内の油に浸漬して冷却する熱処理装置において、鋼材ワークの表面に付着する蒸気膜を鋼材ワークから十分に分離、取去る熱処理装置を提供。
【解決手段】冷却油８を入れた焼入れ油槽６を有する焼入れ室２と、焼入れ室２のエレベータ７に搭載された鋼材ワークW1は、焼入れ室２上部に設けたエレベータ昇降シリンダ４により下降、上昇させられる。焼入れ油槽６内の油８に浸漬した状態で鋼材ワークW1を下降、上昇させるとき、エレベータ昇降シリンダ４には加振装置により縦方向の微小振動が加えられる。
【選択図】図１



【特許請求の範囲】
【請求項１】
冷却油を入れた焼入れ油槽を有する焼入れ室と、焼入れ室に設けられた加熱された鋼材ワークを下降、上昇させるワーク昇降手段と、前記焼入れ油槽内の油に浸漬した状態で前記鋼材ワークを下降、上昇させるとき前記ワーク昇降手段に縦方向の微小振動を加える加振装置と、を有することを特徴とする熱処理装置。
【請求項２】
前記加振装置の前記微小振動は、振動数が１～50Hz、振幅 0.1～１mmとすることを特徴とする請求項１記載の熱処理装置。
【請求項３】
前記ワーク昇降手段に縦方向の微小振動を加えて前記鋼材ワークを複数回繰り返し下降、上昇させるようにし、及び／又は前記鋼材ワークが前記焼入れ油槽内の油面より上昇した後まで所定時間継続して前記ワーク昇降手段に前記微小振動を加えるようにしたことを特徴とする請求項１又は請求項２記載の熱処理装置。
【請求項４】
前記焼入れ油槽には、前記鋼材ワークの焼入れが終了し、鋼材ワークが前記油中から出た状態で、焼入れ油槽内の油を攪拌・冷却する攪拌フアン及び整流ダクトを設けられたことを特徴とする請求項１、請求項２又は請求項３記載の熱処理装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は加熱された鋼材ワークを焼入れ室の焼入れ油槽内の油に浸漬して冷却する熱処理装置に関する。
【背景技術】
【０００２】
加熱された鋼材ワークを焼入れ室の焼入れ油槽内の油に浸漬して冷却する際、焼入れ油に浸漬後、蒸気膜段階、沸騰段階及び対流段階があり、蒸気膜段階で鋼材ワークの表面に付着した蒸気膜が残留し、この蒸気膜により鋼材ワーク表面の冷却むらとなり、鋼材ワークの変形、歪みを発生させることはよく知られている。かかる鋼材ワークの表面に付着した蒸気膜を鋼材ワークから分離させる熱処理装置としては、例えば特許文献１では鋼材ワークを焼入れ油槽内の油に浸漬した状態で浸漬した鋼材ワークを複数回繰り返して上下に変位させる熱処理装置が開示され、特許文献２及び特許文献３では、焼入れ油槽の油を振動、攪拌手段により振動、攪拌する熱処理装置が開示されている。
【特許文献１】特開２０００－１２９３３９公報
【特許文献２】特開２００１－６４７２２号公報
【特許文献３】特開２００３－２８６５１７号公報
【発明の開示】
【発明が解決しようとする課題】
【０００３】
従来の特許文献１の鋼材ワークの表面に付着した蒸気膜を鋼材ワークから分離させる熱処理装置では、鋼材ワークを焼入れ油槽内の油に浸漬した状態で浸漬した鋼材ワークを複数回繰り返して上下に変位させるが、鋼材ワークが油に浸漬し始めてから完全に浸漬するまでの間に発生する蒸気膜は鋼材ワークの表面に付着したままであり、また複数回繰り返して上下に変位させのみでは、十分に蒸気膜を鋼材ワークから分離させることができず、これら残留蒸気膜による鋼材ワークの変形、歪みを発生させた。また特許文献２及び特許文献３では、焼入れ油槽の油を振動、攪拌手段により振動、攪拌するが、振動、攪拌手段から伝播された油の流れが直接触れる鋼材ワーク表面の蒸気膜にはある程度有効であるが、振動、攪拌手段に対し死角になる位置の鋼材ワーク表面の蒸気膜除去はできなく、これら残留蒸気膜による鋼材ワークの変形、歪みを発生させた。
【０００４】

本発明の課題は、上述した従来技術の課題を解決した、加熱された鋼材ワークを焼入れ油槽内の油に浸漬して冷却する熱処理装置において、鋼材ワークの表面に付着する蒸気膜を鋼材ワークから十分に分離、取去り、かつトレイ又はバスケットに搭載した鋼材ワークを全て同一の条件で油中にて冷却させる熱処理装置を提供することにある。

【課題を解決するための手段】

【０００５】

このため本発明によると、冷却油を入れた焼入れ油槽を有する焼入れ室と、焼入れ室に設けられた加熱された鋼材ワークを下降、上昇させるワーク昇降手段と、前記焼入れ油槽内の油に浸漬した状態で前記鋼材ワークを下降、上昇させるとき前記ワーク昇降手段に縦方向の微小振動を加える加振装置と、を有することを特徴とする熱処理装置によって上述の本発明の課題を解決した。

【発明の効果】

【０００６】

本発明では、焼入れ油槽内の油に浸漬した状態で鋼材ワークを下降、上昇させるときワーク昇降手段に縦方向の微小振動を加える加振装置を有するので、鋼材ワークを焼入れ油槽内の油に浸漬後の蒸気膜段階で、鋼材ワークから蒸気膜を除去することができ、かつ沸騰段階においても、油の細い攪拌を発生させて油温の均一化が図られ、鋼材ワークの表面に付着する蒸気膜を鋼材ワークから十分に分離、取去り、かつトレイ又はバスケットに搭載した鋼材ワークを全て同一の条件で油中にて冷却させる熱処理装置を提供するものとなった。

【０００７】

好ましくは、前記加振装置の前記微小振動は、振動数が１～50Hz、振幅 0.1～１mmとしてもよい。振動数が１又は振幅が 0.1未満ではワーク昇降手段と加振装置との連結部の隙間と比べて振動数又は振幅が小さく加振装置にワーク昇降手段が追従しないおそれがあり、振動数が50Hz又は振幅１mmを越えると装置が大きくなり過ぎるので、振動数が１～50Hz、振幅 0.1～１mmに限定した。

さらに好ましくは、前記ワーク昇降手段に縦方向の微小振動を加えて前記鋼材ワークを複数回繰り返し下降、上昇させるようにして、鋼材ワークの表面に付着する蒸気膜を鋼材ワークからより十分に分離、取去るようにし、及び／又は、鋼材ワークが焼入れ油槽内の油面より上昇した後まで所定時間継続してワーク昇降手段に微小振動を加えるようにして、鋼材ワークの表面に付着する油分を振り落とすようにしてもよい。

【発明を実施するための最良の形態】

【０００８】

本発明を実施するための最良の形態につき、図面を参照して説明する。図１（ａ）は本発明を実施するための最良の形態のインアウト形（同一の入口からワークを搬入しかつ搬出する形態の）バッチ炉としての熱処理装置の概略ブロック図で、図１（ｂ）のＡ－Ａ線に沿った概略断面図で示し、図１（ｂ）は（ａ）のＢ－Ｂ線に沿った要部概略断面図で示す。図２は図１（ａ）のワーク昇降手段であるエレベータ昇降シリンダ４に縦方向の微小振動を加える加振装置の駆動システムを油圧回路図で示し、図３は図１（ａ）のエレベータ昇降シリンダ４に縦方向の微小振動を加えながら鋼材ワークW1を下降、上昇させるいろいろな動作パターンの各軌跡を示す。

【０００９】

図１（ａ）に示すように、本発明を実施するための最良の形態の熱処理装置１は、冷却油８を入れた焼入れ油槽６を有する焼入れ室２と、図示しない加熱装置により加熱を行う加熱室３と、からなり、加熱室３で加熱された点線で示す鋼材ワークW3は、図示しない移動手段で焼入れ室２の実線で示すエレベータ７上に移動された後、焼入れ室２のエレベータ７に搭載された鋼材ワークW1は、焼入れ室２上部に設けたエレベータ昇降シリンダ４により下降、上昇させられる。焼入れ油槽６内の油８に浸漬した状態で鋼材ワークW1を下降、上昇させるとき、エレベータ昇降シリンダ４には図２に示す加振装置により縦方向の微小振動が加えられる。

【００１０】
図１（ｂ）に示すように、焼入れ油槽６には、鋼材ワークW2焼入れが終了し、鋼材ワークW2が油８中から出た状態で、焼入れ油槽６内の油８を攪拌・冷却するモータ９で回転される攪拌フアン10及び整流ダクト11が設けられている。エレベータ昇降シリンダ４が動作中は攪拌フアン10は停止状態にされ、焼入れが終了し、鋼材ワークW2が油８中から出た状態で、焼入れ油槽６に設けられた図示しない熱交換器により、冷却を行いながらモータ９で攪拌フアン10を回転させて油８を所定の温度になるまで攪拌・冷却する。
【００１１】
図２に示すエレベータ昇降シリンダ４に縦方向の微小振動を発生させる加振装置の駆動システムは、図２の油圧回路図で示すように、加振シリンダであるエレベータ昇降シリンダ４のロッド52に取り付けた位置センサー53、位置センサー53のフイードバック位置信号を増幅するサーボ駆動用増幅器54、サーボ駆動用増幅器54のフイードバック位置信号が入力される縦加振サーボ駆動用増幅器56、加振シリンダであるエレベータ昇降シリンダ４のロッド52の振動数・振幅・差圧を指令する縦方向加振用関数発生器55、縦方向加振用関数発生器55の振動数・振幅・差圧指令信号は上記縦加振サーボ駆動用増幅器56に入力され、縦加振サーボ駆動用増幅器56の振動数・振幅・差圧を指令する指令信号に応じた振動数・振幅・差圧を発生させる縦加振用サーボバルブ57、を含む。縦加振用サーボバルブ57はモータ58に駆動される油圧ポンプ59、加振シリンダであるエレベータ昇降シリンダ４と連結されている。加振シリンダであるエレベータ昇降シリンダ４以外の駆動システム装置は焼入れ室２に隣接した図示しない位置に配置されている。エレベータ昇降シリンダ４に支持されたエレベータ７内の鋼材ワークW1が焼入れ油槽６内の油８の油面12に近接したことを、位置センサー53のフイードバック位置信号が検知すると、縦方向加振用関数発生器55でセッチングした振動数・振幅・差圧を指令する指令信号が発生され、縦加振用サーボバルブ57は、加振シリンダであるエレベータ昇降シリンダ４のロッド52に指令信号に応じた振動数・振幅・差圧を発生させる。このときの縦加振条件は、振動数が１～50Hz、振幅 0.1～１mmの微小振動が好ましい。振動数が１又は振幅が 0.1未満ではエレベータ昇降シリンダ４のロッド52と加振シリンダ51との連結部の隙間と比べて振動数又は振幅が小さく加振装置にワーク昇降手段が追従しないおそれがあり、振動数が50Hz又は振幅１mmを越えると装置が大きくなり過ぎるからである。
【００１２】
図３は図１（ａ）のワーク昇降手段であるエレベータ昇降シリンダ４のロッド52に縦方向の微小振動を加えて鋼材ワークW1を下降、上昇させるいろいろな動作パターンの各軌跡を示す。図３（ａ）は図１の実線で示すエレベータ７及び鋼材ワークW1が原位置即ち上昇端位置から、焼入れ油槽６内の油８の油面12に近接するまで早送りで下降され、油侵開始後は予めセッチングした振動数・振幅・差圧を、加振シリンダであるエレベータ昇降シリンダ４のロッド52に縦方向加振を加えながら図１の点線で示すエレベータ７及び鋼材ワークW2の下降端位置まで下降する。下降端位置では図示しないタイマーにより僅かの時間停止させた後、縦方向加振を加えながらエレベータ７及び鋼材ワークW2が上昇させられる。鋼材ワークW2底面が油８の油面12まで上昇した位置で、縦方向加振を止め、上昇端位置まで早戻りするようにされている。
【００１３】
図３（ｂ）は図３（ａ）とは異なり、鋼材ワークW2が焼入れ油槽６内の油８の油面12より上昇した後まで所定時間継続してエレベータ昇降シリンダ４のロッド52に微小振動を加えるようにし、鋼材ワークの表面に付着する油分を振り落とすようにし、油槽６内から持ち出す油を減少させたものである。
図３（ｃ）は図３（ａ）のパターンを複数回繰り返し下降、上昇させるようにし、鋼材ワークの表面に付着する蒸気膜を鋼材ワークからより十分に分離、取去るようにした。
図３（ｄ）は図３（ｃ）に図３（ｂ）のパターンを重ね、図３（ａ）のパターンを複数回繰り返し下降、上昇させるようにし、かつ鋼材ワークW2が焼入れ油槽６内の油８の油面12より上昇した後まで所定時間継続してエレベータ昇降シリンダ４のロッド52に微小振動

を加えるようにしたものである。

【実施例１】

【００１４】

材質SCr420、モジュール 2.0、圧力角20°、歯数76、捩じれ角30° RH、ピッチ円径 175.524mm、歯幅24mmのヘリカル外歯車10個を、図１で示す本発明の熱処理装置１を使用し、浸炭処理を加えた熱処理後、850 °Ｃまで降温し、本発明の装置で油温150 °Ｃの油中に浸漬し焼入れした。本発明の方法で焼入れ後のヘリカル外歯車の捩じれ角変形量を測定したところ、10～25μｍの変形量とばらつきであった。同一仕様の焼入れ前のヘリカル外歯車10個を図１（ｂ）に示す攪拌フアン10及び整流ダクト11を使用し攪拌しながらエレベータ昇降シリンダ４のロッド52に縦方向加振を加えないで下降、上昇させる従来方法で焼入れし、焼入れ後のヘリカル外歯車の捩じれ角変形量を測定したところ、20～45μｍの変形量とばらつきであった。本発明の装置で焼入れしたヘリカル外歯車の捩じれ角変形量は、従来方法で焼入れしたものに比べ、変形量とばらつき共約半減した。

〔本発明の最良の実施形態の効果〕

【００１５】

本発明の最良の実施形態では、焼入れ油槽内の油に浸漬した状態で鋼材ワークを下降、上昇させるときワーク昇降手段に縦方向の微小振動を加える加振装置を有するので、鋼材ワークを焼入れ油槽内の油に浸漬後の蒸気膜段階で、鋼材ワークから蒸気膜を除去することができ、かつ沸騰段階においても、油の細い攪拌を発生させて油に冷却効果を与え、油温の均一化が図られ、鋼材ワークの表面に付着する蒸気膜を鋼材ワークから十分に分離、取去り、かつトレイ又はバスケットに搭載した鋼材ワークを全て同一の条件で油中にて冷却させる熱処理装置を提供するものとなった。

【００１６】

好ましくは、加振装置の微小振動は、振動数が１～50Hz、振幅 0.1～１mmとしてもよい。振動数が１又は振幅が 0.1未満ではワーク昇降手段と加振装置との連結部の隙間と比べて振動数又は振幅が小さく加振装置にワーク昇降手段が追従しないおそれがあり、振動数が50Hz又は振幅１mmを越えると装置が大きくなり過ぎるので、振動数が１～50Hz、振幅 0.1～１mmに限定した。

さらに好ましくは、エレベータ昇降シリンダのロッドに縦方向の微小振動を加えて鋼材ワークを複数回繰り返し下降、上昇させるようにして、鋼材ワークの表面に付着する蒸気膜を鋼材ワークからより十分に分離、取去るようにし、及び／又は鋼材ワークが焼入れ油槽内の油面より上昇した後まで所定時間継続してワーク昇降手段に微小振動を加えるようにして、鋼材ワークの表面に付着する油分を振り落とすようにしてもよい。

【００１７】

本発明の最良の実施形態では、エレベータ昇降手段をシリンダの例により説明したが、エレベータ昇降手段はサーボモータ等の電気駆動手段であってもよく、又、実施形態では、インアウト形バッチ炉としての熱処理装置の例により説明したが、冷却油を入れた焼入れ油槽を有する焼入れ室と、焼入れ室に設けられた加熱された鋼材ワークを下降、上昇させるワーク昇降手段とを有するすべての熱処理装置に使用できる。

【図面の簡単な説明】

【００１８】

【図１】（ａ）は本発明を実施するための最良の形態のインアウト形バッチ炉としての熱処理装置の概略ブロック図で、図１（ｂ）のＡ－Ａ線に沿った概略断面図で示し、図１（ｂ）は（ａ）のＢ－Ｂ線に沿った要部概略断面図で示す。

【図２】図１（ａ）のワーク昇降手段であるエレベータ昇降シリンダ４に縦方向の微小振動を加える加振装置の駆動システムを油圧回路図で示す。

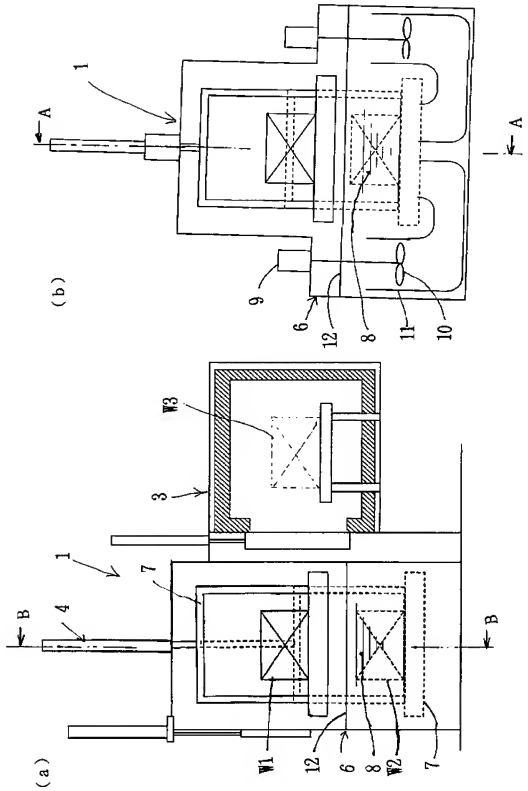
【図３】図１（ａ）のエレベータ昇降シリンダ４に縦方向の微小振動を加えながら鋼材ワークW1を下降、上昇させるいろいろな動作パターンの各軌跡を示す。

【符号の説明】

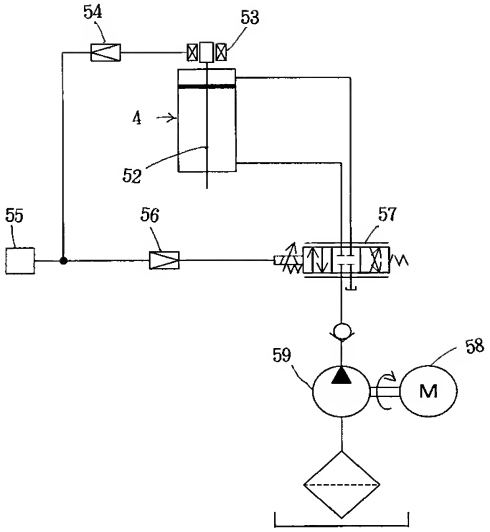
【００１９】

１：熱処理装置　　２：焼入れ室
４：エレベータ昇降シリンダ（ワーク昇降手段）
６：焼入れ油槽　　７：エレベータ
８：冷却油　　10：攪拌フアン　　11：整流ダクト
W1，W2，W3：鋼材ワーク

【図１】



【図２】



【図３】